

WHAT IS CLAIMED IS:

1. A method for producing magnetic recording media, the method comprising:
forming a magnetic layer over a substrate;
ionizing a source material so as to form a plasma containing ions which comprise carbon; and
energizing the ions to form a stream from the plasma toward the substrate so that carbon from the ions is deposited on the substrate, wherein the ions impact with an energy which promotes formation of sp^3 carbon-carbon bonds.

2. A method as claimed in claim 1, further comprising selectively energizing the stream with a predetermined impact energy.

3. A method as claimed in claim 1, wherein the stream impacting the substrate is primarily composed of ions having a uniform weight.

4. A method as claimed in claim 1, wherein the impact energy of the ions is substantially uniform.

5. A method as claimed in claim 1, further comprising filtering the stream to control weight and impact energy of the ions impacting the substrate.

6. A method as claimed in claim 5, wherein the filtering step comprises obstructing a path between the source material and the substrate, and guiding the ions of the stream around the obstruction.

7. A method as claimed in claim 6, wherein the stream is filtered through a curvilinear electromagnetic duct.

8. A method as claimed in claim 1, wherein the ionizing step comprises interelectrode vaporization of the

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1 source material, the source material comprising a solid carbon
2 cathode.

1 ~~14~~ 9. A method as claimed in claim ~~8~~ ¹³, wherein the
2 energizing step comprises electrostatically biasing the ions
3 toward the substrate.

1 ~~15~~ 10. A method as claimed in claim 1, wherein the
2 energizing step comprises selectively accelerating the ions
3 toward the substrate to provide the impact energy.

1 ~~16~~ 11. A method as claimed in claim ~~10~~ ¹⁵, wherein the
2 selectively energizing step comprises varying the potential of
3 a cathodic arc source.

1 12. A method as claimed in claim 1, wherein the
2 energizing step comprises applying an alternating potential
3 between a coupling electrode and an extraction grid having a
4 smaller surface area than the coupling electrode so that the
5 plasma is self-biasing relative to the extraction grid.

1 13. A method as claimed in claim 1, wherein the
2 source material comprises a gas having a substantially
3 coherent dissociation energy spectra.

1 ~~19~~ 14. A method as claimed in claim ~~13~~ ¹⁸, wherein the
2 source material comprises acetylene.

1 ~~5~~ 15. A method as claimed in claim 1, wherein the
2 impact energy is between about 57 and 130 eV for each carbon
3 atom.

1 ~~6~~ 16. A method as claimed in claim 15, wherein the
2 impact energy is between about 100 and 120 eV for each carbon
3 atom.

1 17. Magnetic recording media comprising:
2 a substrate;

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1 a magnetic layer disposed over the substrate; and
2 a protective layer disposed over the magnetic layer,
3 the protective layer comprising a highly tetrahedral amorphous
4 carbon.

1 18. A recording media as in claim 17, wherein the
2 highly tetrahedral amorphous carbon of the protective layer
3 includes more than about 35% sp^3 carbon-carbon bonds.

1 19. A recording media as in claim 17, wherein the
2 highly tetrahedral amorphous carbon of the protective layer
3 includes more than about 70% sp^3 carbon-carbon bonds.

1 20. A recording media as in claim 17, wherein the
2 sp^3 carbon-carbon bonds are at least in part formed by
3 directing an energized stream of carbon ions toward the
4 substrate.

1 21. A recording media as in claim 17, wherein the
2 density of the protective layer is more than 2.5 g/cm^3 .

1 22. A recording media as in claim 17, wherein the
2 highly tetrahedral amorphous carbon of the protective layer
3 does not include macroparticles.

1 23. A recording media as in claim 17, wherein the
2 protective layer has a hardness of over about 50 GPa.

1 24. A recording media as in claim 17, wherein the
2 protective layer has a thickness of less than about 75 Å.

1 25. A recording media as in claim 17, wherein the
2 highly tetrahedral amorphous carbon of the protective layer
3 further comprises hydrogen.

1 26. A recording media as in claim 25, wherein the
2 protective layer comprises between about 8 and 18 atomic
3 percent hydrogen.

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1 27. A recording media as in claim 17, wherein the
2 highly tetrahedral amorphous carbon of the protective layer
3 further comprises nitrogen.

1 28. A recording media as in claim 26, wherein the
2 protective layer comprises between about 4 and 30 atomic
3 percent nitrogen.

1 29. A method for enhancing an ion beam, the ion
2 beam produced by inductively ionizing a plasma within a plasma
3 volume and capacitatively coupling the plasma so as to form a
4 stream of ions from within the plasma volume, the method
5 comprising:

6 moving a magnetic field through the plasma volume to
7 promote even resonant inductive ionization and homogenize the
8 ion beam.

1 30. A method as claimed in claim 29, wherein moving
2 the magnetic field comprises selectively energizing magnetic
3 coils disposed about the plasma volume.

1 31. A method as claimed in claim 29, wherein the
2 magnetic field rotates through the plasma volume with a
3 frequency which is much less than the frequency of an
4 alternating induction potential.

1 32. A method as claimed in claim 29, wherein the
2 magnetic field is transverse and rotates about an axis which
3 is substantially normal to a capacitatively coupled extraction
4 grid.

1 33. A method as claimed in claim 29, wherein the
2 magnetic field rotates with a frequency of less than 10,000
3 Hz.

1 34. An inductive ionization resonance system for
2 use with an ion-beam source including an antenna disposed
3 about a plasma volume for inductively ionizing a plasma

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1 therein, a coupling electrode exposed to the plasma volume,
2 and an extraction electrode disposed over an opening of the
3 plasma volume so that the extraction electrode is capable of
4 extracting a stream of ions of the plasma therethrough by
5 capacitive coupling, the system comprising at least one coil
6 disposed adjacent the plasma volume, the at least one coil
7 capable of moving a transverse magnetic field through the
8 plasma volume to homogenize the stream of ions.

1 35. A system as claimed in claim 34, further
2 comprising a plurality of coils disposed about the container
3 so that the magnetic field can be moved within the plasma
4 volume by selectively energizing one or more coils.

1 36. A system as claimed in claim 35, wherein the
2 plurality of coils are radially disposed about the axis.

1 37. A system as claimed in claim 34, wherein the
2 plasma volume substantially defines a length and a diameter,
3 wherein the opening is disposed at one end of the length, and
4 wherein the length is between about one third the diameter and
5 three times the diameter.

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